

N-Channel Power MOSFET (1.2A, 600Volts)

DESCRIPTION

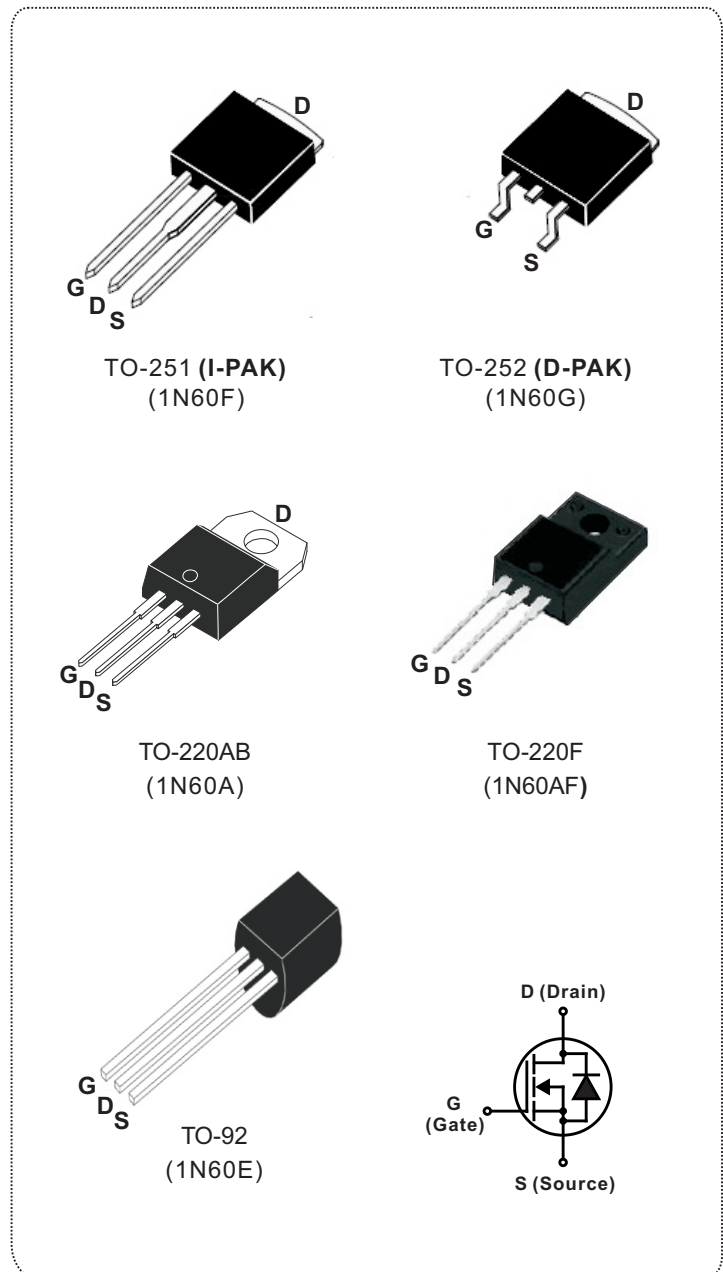
The Nell **1N60** is a three-terminal silicon device with current conduction capability of 1.2A, fast switching speed, low on-state resistance, breakdown voltage rating of 600V, and max. threshold voltage of 4 volts.

They are designed for use in applications such as switched mode power supplies, DC to DC converters, **PWM** motor controls, bridge circuits and general purpose switching applications.

FEATURES

- $R_{DS(ON)} = 11.5\Omega @ V_{GS} = 10V$
- Ultra low gate charge(6nC max.)
- Low reverse transfer capacitance ($C_{RSS} = 3pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature

PRODUCT SUMMARY	
I_D (A)	1.2
V_{DSS} (V)	600
$R_{DS(ON)}$ (Ω)	1.15 @ $V_{GS} = 10V$
Q_G (nC) max.	6

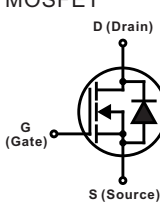


ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise specified)					
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT	
V_{DSS}	Drain to Source voltage	$T_J=25^\circ\text{C}$ to 150°C	600	V	
V_{DGR}	Drain to Gate voltage	$R_{GS}=20\text{K}\Omega$	600		
V_{GS}	Gate to Source voltage		± 30		
I_D	Continuous Drain Current	$T_C=25^\circ\text{C}$	1.2	A	
		$T_C=100^\circ\text{C}$	0.74		
I_{DM}	Pulsed Drain current(Note 1)		4.8		
I_{AR}	Avalanche current(Note 1)		1.2		
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR}=1\text{A}$, $R_{GS}=50\Omega$, $V_{GS}=10\text{V}$	4	mJ	
E_{AS}	Single pulse avalanche energy (Note 2)	$I_{AS}=1\text{A}$, $L = 60\text{mH}$	50		
dv/dt	Peak diode recovery dv/dt(Note 3)		4.5	V/ns	
P_D	Total power dissipation	$T_C=25^\circ\text{C}$	TO-251/ TO-252	28	W
			TO-220AB	40	
			TO-220F	21	
		$T_A=25^\circ\text{C}$	TO-92	1	
T_J	Operation junction temperature		-55 to 150	$^\circ\text{C}$	
T_{STG}	Storage temperature		-55 to 150		
T_L	Maximum soldering temperature, for 10 seconds	1.6mm from case	300		
	Mounting torque, #6-32 or M3 screw	For TO-220AB / TO-220F	10 (1.1)	lbf·in (N·m)	

Note: 1.Repetitive rating: pulse width limited by junction temperature.
 2. $I_{AS} = 1\text{A}$, $V_{DD} = 50\text{V}$, $L = 60\text{mH}$, $R_{GS} = 25\Omega$, starting $T_J=25^\circ\text{C}$.
 3. $I_{SD} \leq 1.2\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, starting $T_J=25^\circ\text{C}$.

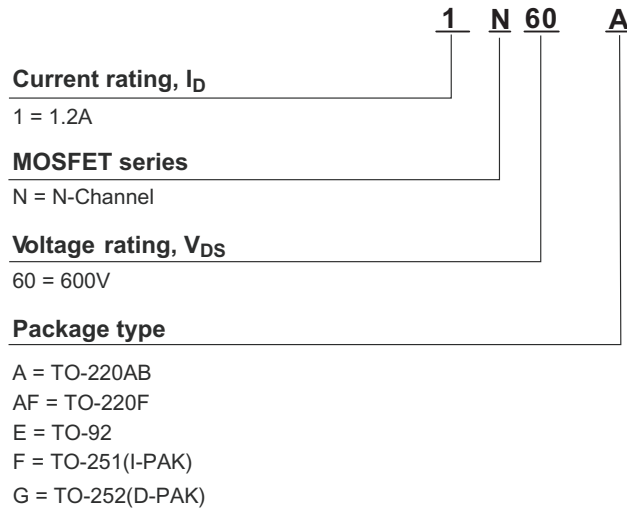
THERMAL RESISTANCE					
SYMBOL	PARAMETER	Min.	Typ.	Max.	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case	TO-251/ TO-252		4.5	$^\circ\text{C}/\text{W}$
		TO-220AB		3.1	
		TO-220F		6	
$R_{th(j-a)}$	Thermal resistance, junction to ambient	TO-251/TO-252		110	
		TO-220AB		62.5	
		TO-220F		62.5	
		TO-92		140	

ELECTRICAL CHARACTERISTICS (T _C = 25°C unless otherwise specified)							
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT	
◎ OFF CHARACTERISTICS							
V _{(BR)DSS}	Drain to source breakdown voltage	I _D = 250μA, V _{GS} = 0V	600			V	
ΔV _{(BR)DSS} /ΔT _J	Breakdown voltage temperature coefficient	I _D = 250μA, V _{DS} = V _{GS}		0.4		V/°C	
I _{DSS}	Drain to source leakage current	V _{DS} =600V, V _{GS} =0V T _C = 25°C			10	μA	
		V _{DS} =480V, V _{GS} =0V T _C =125°C			100		
I _{GSS}	Gate to source forward leakage current	V _{GS} = 30V, V _{DS} = 0V			100	nA	
	Gate to source reverse leakage current	V _{GS} = -30V, V _{DS} = 0V			-100		
◎ ON CHARACTERISTICS							
R _{DS(ON)}	Static drain to source on-state resistance	I _D = 0.6A, V _{GS} = 10V		9.5	11.5	Ω	
V _{GS(TH)}	Gate threshold voltage	V _{GS} =V _{DS} , I _D =250μA	2.0		4.0	V	
◎ DYNAMIC CHARACTERISTICS							
C _{ISS}	Input capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1MHz		120	150	pF	
C _{OSS}	Output capacitance				20		25
C _{RSS}	Reverse transfer capacitance				3.0		4.0
◎ SWITCHING CHARACTERISTICS							
t _{d(ON)}	Turn-on delay time	V _{DD} = 300V, V _{GS} = 10V, I _D = 1.2A, R _{GS} = 50Ω (Note 1, 2)		5	20	ns	
t _r	Rise time				25		60
t _{d(OFF)}	Turn-off delay time				7		25
t _f	Fall time				25		60
Q _G	Total gate charge	V _{DD} = 480V, V _{GS} = 10V, I _D = 1.2A (Note 1, 2)		5.0	6.0	nC	
Q _{GS}	Gate to source charge				1.0		
Q _{GD}	Gate to drain charge (Miller charge)				2.5		

SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS (T _C = 25°C unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	Min.	Typ.	Max.	UNIT
V _{SD}	Diode forward voltage	I _{SD} = 1.2A, V _{GS} = 0V			1.4	V
I _S (I _{SD})	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET 			1.2	A
I _{SM}	Pulsed source current					
t _{rr}	Reverse recovery time	I _{SD} = 1.2A, V _{GS} = 0V,		160		ns
Q _{rr}	Reverse recovery charge	dI _F /dt = 100A/μs		0.3		μC

Note: 1. Pulse test: Pulse width ≤ 300μs, duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

ORDERING INFORMATION SCHEME



■ TEST CIRCUITS AND WAVEFORMS

Fig.1A Peak diode recovery dv/dt test circuit

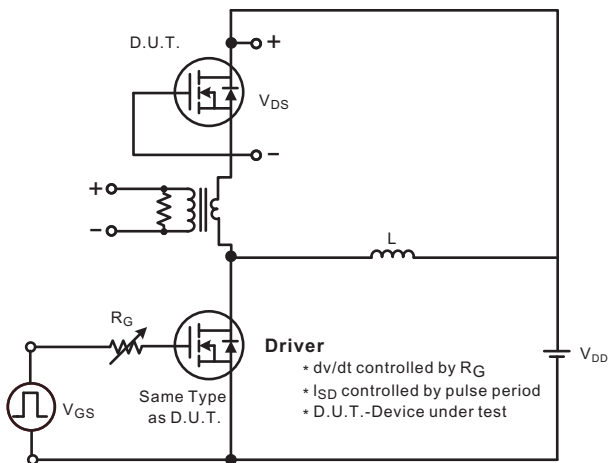
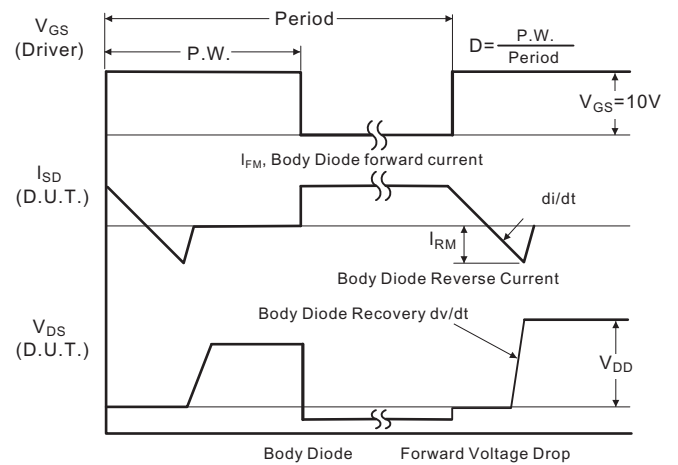


Fig.1B Peak diode recovery dv/dt waveforms



TEST CIRCUITS AND WAVEFORMS (Cont.)

Fig.2A Switching test circuit

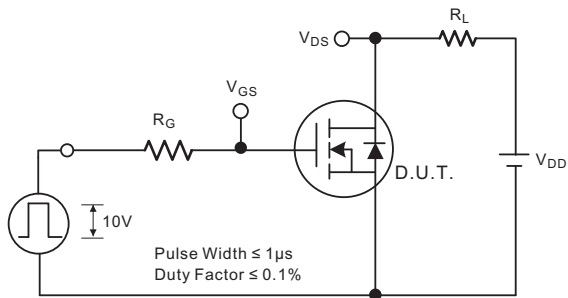


Fig.2B Switching Waveforms

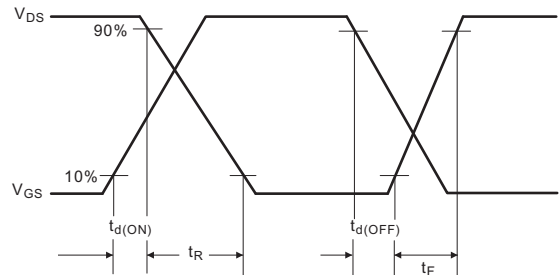


Fig.3A Gate charge test circuit

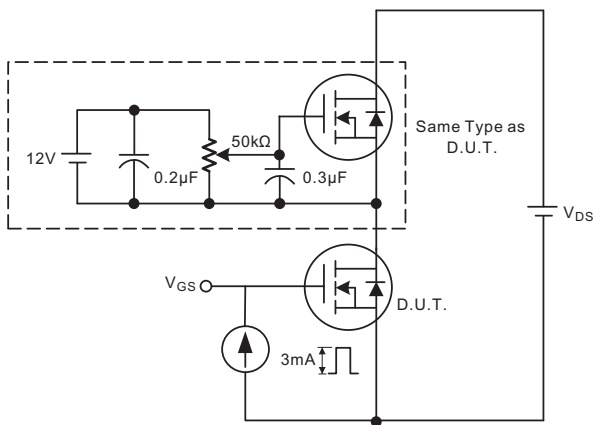


Fig.3B Gate charge waveform

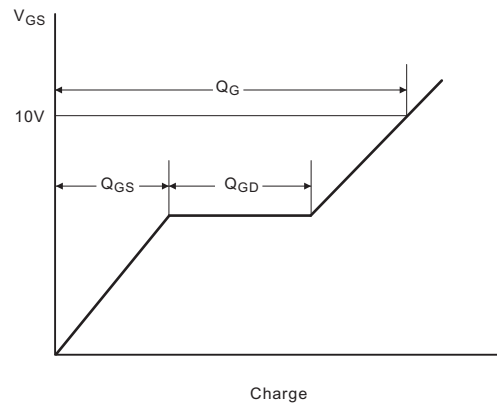


Fig.4A Unclamped Inductive switching test circuit

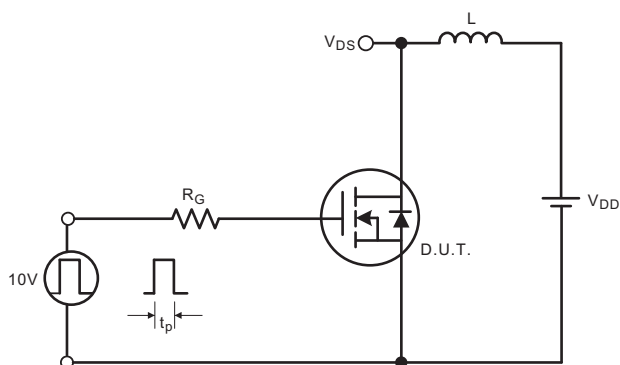
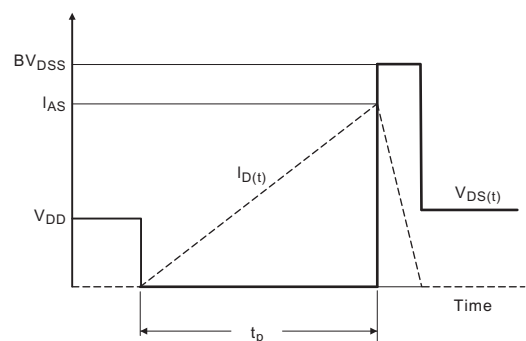


Fig.4B Unclamped Inductive switching waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 Drain current vs. Source to drain voltage

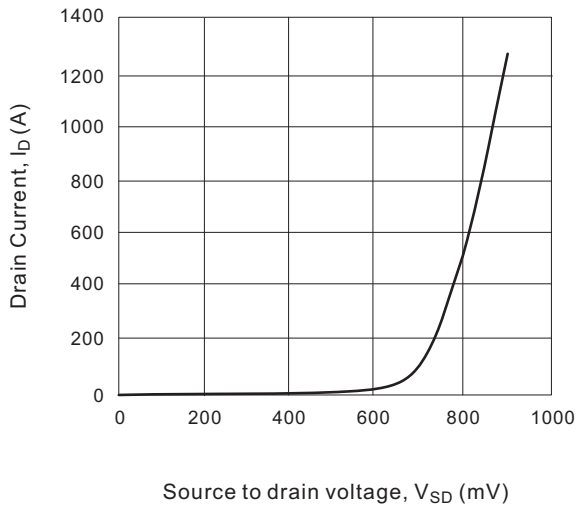


Fig.2 Drain-source on-state resistance characteristics

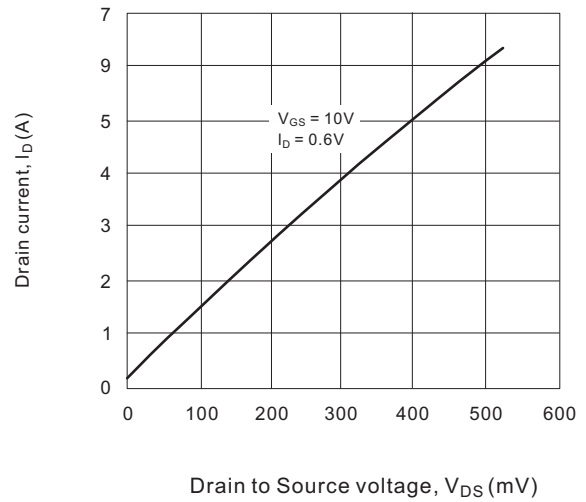


Fig.3 Drain current vs. Gate threshold voltage

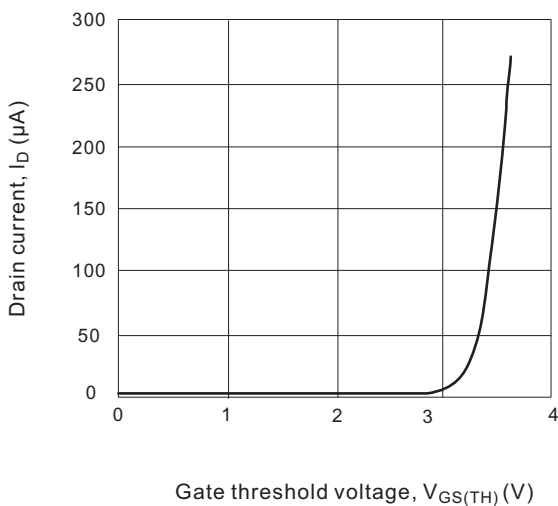
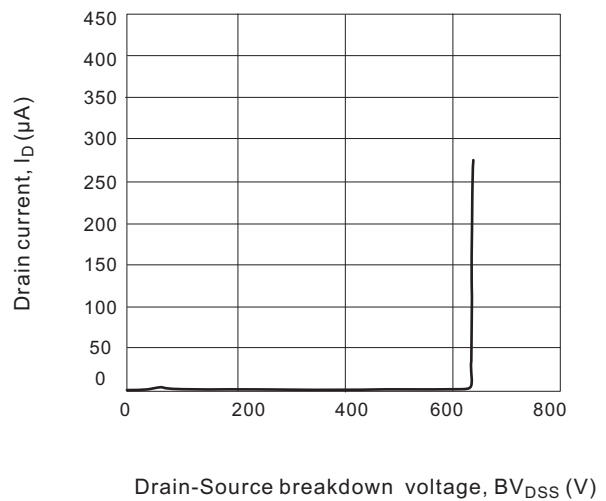
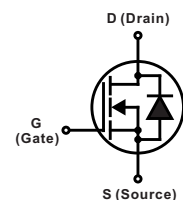
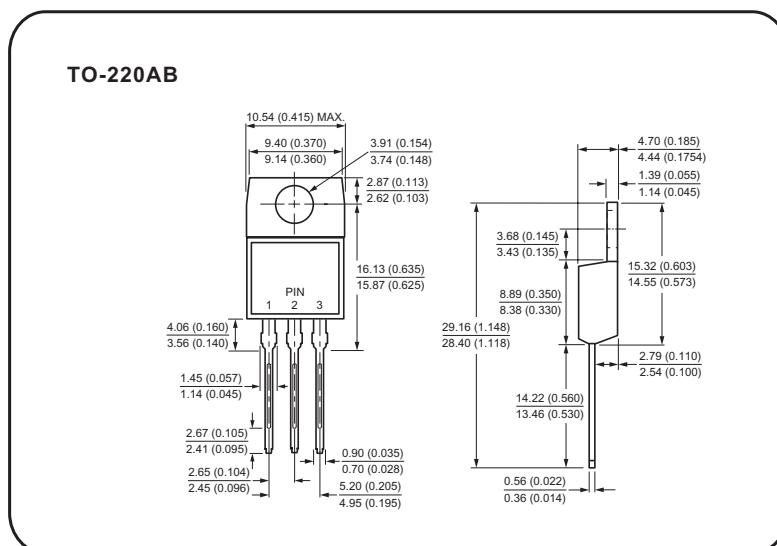
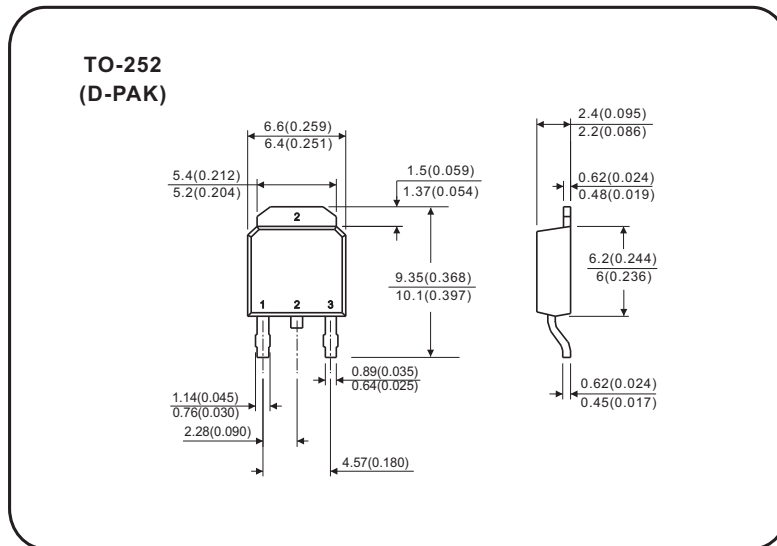
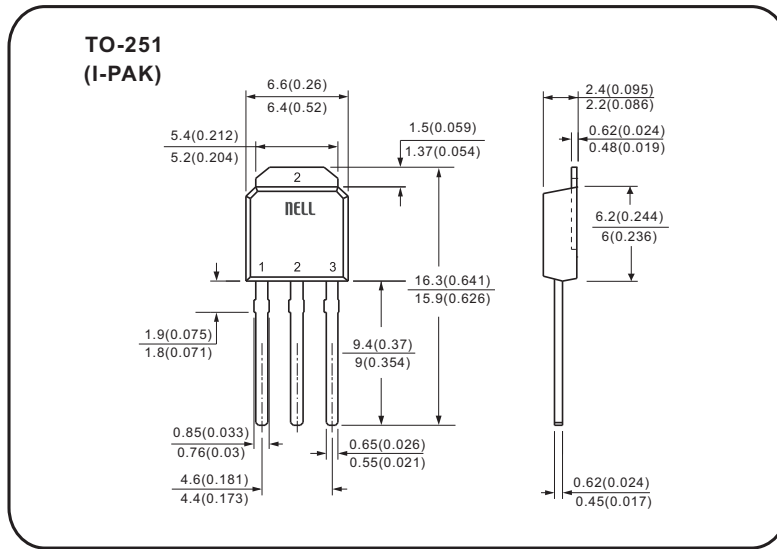


Fig.4 Drain current vs. Drain-Source breakdown voltage



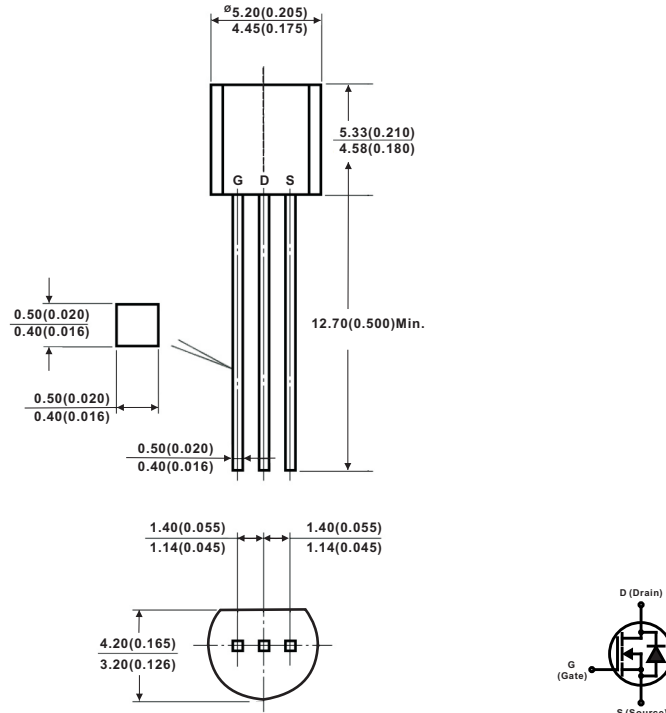
Case Style



All dimensions in millimeters(inches)

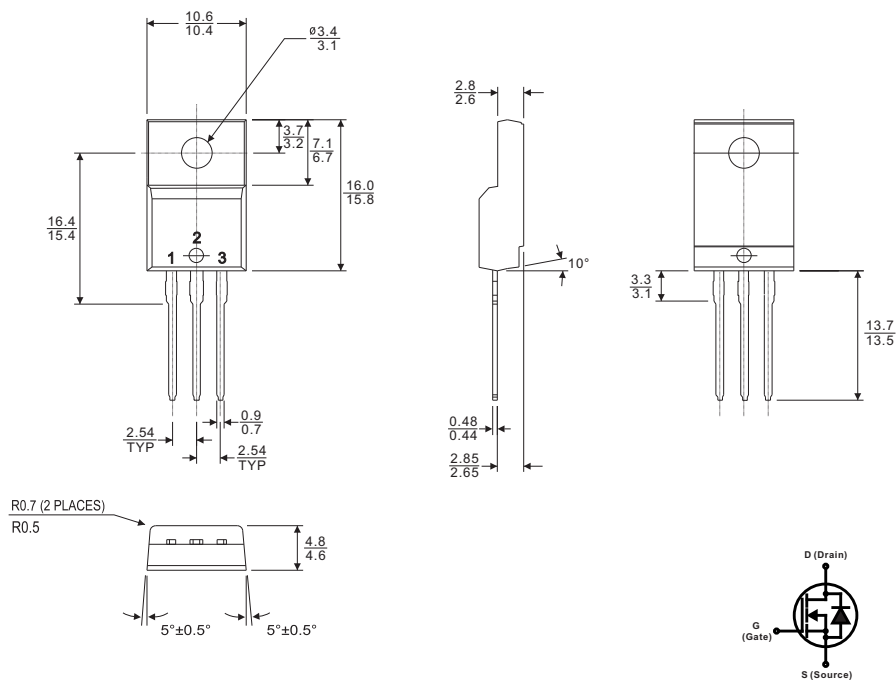
Case Style

TO-92



All dimensions in millimeters

TO-220F



All dimensions in millimeters